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Development of a Risk Warning Factor Assessment Scale for Malnutrition in Stroke Recovery Patients

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Abstract: *Objective*: To develop a risk warning factor assessment scale for malnutrition in patients during the recovery phase of stroke, providing a basis for evaluating malnutrition risk in this population. *Methods*: Literature review and group discussions were initially used to screen potential risk factors for malnutrition in stroke recovery patients. The modified Delphi method was then employed to finalize the risk factor assessment scale. From 1st April 2022 to 1st June 2022, two rounds of expert consultations were conducted via WeChat, face-to-face interviews, and email. Data from the experts' ratings and modification suggestions for each item were recorded using Excel 2013, and statistical analysis was performed using SPSS 26.0 to determine the final risk warning factor assessment scale. *Results*: Two rounds of expert consultations were completed, with response rates (active coefficients) of 96% and 100%, respectively. The judgment basis (Ca) for the two rounds was 0.926 and 0.933, familiarity (Cs) scores were 0.800 and 0.808, and authority coefficients (Cr) were 0.863 and 0.871. The Kendall's W values for importance in the two rounds were 0.192 and 0.154 (both $P < 0.001$), while the Kendall's W values for correlation were 0.071 and 0.061 (both $P < 0.05$), indicating consistency in the experts' evaluations of the indicators. The item-level content validity index (I-CVI) ranged from 0.875 to 1.000, and the scale-level content validity index (S-CVI) was 0.977, demonstrating good content validity of the assessment scale. The final risk factor assessment scale consisted of 38 items across three dimensions. *Conclusion*: The developed malnutrition risk assessment scale for stroke recovery patients exhibits good scientific rigor and practicality, providing a reference for identifying malnutrition risks in this population.

Keywords: Stroke; Recovery phase; Delphi method; Malnutrition; Risk assessment; Scale

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1. Introduction

Stroke ranks first among the causes of death and disability in adults in China. Due to impaired neurological function, patients often experience dysphagia, cognitive impairment, and emotional disorders, and are prone to malnutrition [1]. Studies have shown that approximately 20% of stroke patients suffer from malnutrition, a proportion that rises to as high as 62% by the time of discharge and in the recovery phase [2]. Malnutrition negatively affects patients' rehabilitation outcomes and quality of life, leading to prolonged hospital stays, and is associated with poor clinical prognosis [3–6]. Therefore, early identification of malnutrition risk in stroke patients during the recovery phase and timely individualized intervention can help facilitate successful recovery.

However, existing tools for screening and assessing malnutrition risk are mostly general-purpose instruments [3, 7]. Moreover, the factors influencing malnutrition in stroke patients reported in the literature mostly focus on those in the acute phase, with relatively few studies targeting stroke recovery patients [8]. This hinders the accurate identification of such high-risk patients.

As such, developing an assessment scale for identifying warning factors of malnutrition risk in stroke patients during the recovery phase is of great significance for early detection of high-risk individuals and the formulation of individualized nutritional interventions.

This study, based on the Nutritional Risk Screening 2002 (NRS 2002), aims to construct an assessment scale for warning factors of malnutrition risk tailored to stroke patients in the recovery phase through a review of the literature and a modified Delphi expert consultation method, thereby providing an effective clinical tool.

2. Methods

2.1. Establishment of the research team

The research team consisted of seven members, including one chief physician, one chief nurse, two specialized nurses, one senior nurse, and two graduate students. All nursing team members had more than five years of experience in stroke-related nutrition care and held at least a bachelor's degree or higher. The responsibilities of the research team included: reviewing relevant literature, drafting the assessment scale for warning factors of malnutrition risk in stroke patients during the recovery phase, developing the expert consultation questionnaire, selecting expert consultants, and conducting statistical analysis, discussions, and revisions based on the results of the expert consultations. This study was approved by the Ethics Committee of Hubei University of Medicine (Approval No.: 2022-RE-004).

2.2. Drafting the assessment scale prototype

Based on previous literature reports, Chinese and English search terms—including Stroke, Acute cerebrovascular event, cerebrovascular disease, Cerebrovascular accident (CVA), Cerebral infarction,

cerebral apoplexy, cerebral bleeding, Ischemic stroke, Cerebral thrombosis, Cerebral embolism, Cerebral hemorrhage, Hemorrhagic stroke, Intracranial hemorrhage, recovery period, malnutrition, nutritional insufficiency, Nutritional deficiency, Nutritional disorder, nutritional imbalance, Nutritional risk, Malnutrition risk, Nutrition-related risk, nutrition, nutrition, nutrition risk, influence factor, Influencing factors, Risk factor, Contributing factors, Risk prediction, Risk assessment, and Prognostic prediction—were used to search Chinese databases such as CNKI (China National Knowledge Infrastructure), Wanfang, VIP, and SinoMed (China Biomedical Literature Database) and English databases such as PubMed, Web of Science, Embase, and Cochrane Library [9–10]. The search terms were refined through multiple pre-tests before being applied in the databases, either as subject terms or keywords in titles/abstracts. The retrieval period spanned from the inception of each database to March 30, 2022.

The retrieved literature was reviewed and analyzed in terms of abstracts and full-text content to identify warning factors for malnutrition risk in stroke patients during the recovery period. Considering the applicability and feasibility of these factors in this patient population, nursing experts in neurorehabilitation were invited to supplement and refine the influencing factors. This process led to the initial drafting of the "Warning Factors for Malnutrition Risk Assessment Scale Prototype for Stroke Patients in the Recovery Period", which includes three dimensions and 28 items.

2.3. Preliminary drafting of the assessment scale (initial version)

The research team referred to the Nutrition Risk Screening 2002 (NRS 2002) as a benchmark, statistically analyzing and organizing the retrieved literature to identify risk factors for malnutrition. The applicability of these factors in stroke patients during the recovery period was discussed, and neurorehabilitation medical and nursing experts were invited to further refine the influencing factors. Expert Selection Criteria: (1) ≥10 years of experience in neurorehabilitation medicine/nursing; (2) Bachelor's degree or higher; (3) Intermediate or senior professional title; (4) Familiarity with the study content and voluntary participation. A total of six experts were invited, who adjusted and optimized the assessment tool items.

2.4. Development of the expert Delphi questionnaire

The research team developed the expert Delphi questionnaire through group discussions. The first round of expert consultation was semi-open-ended and comprised three sections. The first section was a cover letter to experts, which included the research background, objectives, instructions for completing the questionnaire, specific filling requirements, and contact information. The second section was the content evaluation form for the Warning Factors of Malnutrition Risk in Stroke Patients in the recovery phase during the Recovery Period, containing the preliminary draft items of the assessment scale, importance ratings for each item and dimension, relevance ratings, and a comments/recommendations column. Importance was assessed using a 5-point Likert scale (5 = Very important, 4 = Important, 3 = Moderately important, 2 = Slightly important, 1 = Not important at all), while relevance was evaluated using a 4-point Likert scale (4 = Highly relevant, 3 = Relevant, 2 = Slightly relevant, 1 = Not relevant at all). Following each dimension and item evaluation, comment and modification sections were included to allow experts to suggest revisions or additional items. The third section collected basic expert information and their evaluation rationale, including demographic details (gender, age, education level, professional title, and work experience) as well as the experts' judgment basis (Ca) and familiarity level (Cs). The judgment basis covered four aspects—theoretical analysis, work

experience, literature references, and personal intuition—each rated by impact level (high, medium, or low), while familiarity was classified into five levels: very familiar, quite familiar, moderately familiar, slightly familiar, and not familiar at all.

2.5. Selection of experts

A total of 21–25 experts were selected from a tertiary Grade A hospital in Shiyan City. Inclusion criteria for experts: (1) ≥10 years of experience in stroke rehabilitation diagnosis and treatment, nutrition, rehabilitation nursing, or nursing management; (2) Bachelor's degree or higher; (3) Intermediate or senior professional title; (4) Familiarity with the assessment items and certain research capabilities; (5) Voluntary participation and ability to complete the expert consultation within the study timeframe. These carefully selected experts ensured high-quality, evidence-based input for refining the assessment scale.

2.6. Implementation of expert Delphi consultation

From 1st April 2022 to 1st June 2022, two rounds of expert Delphi consultations were conducted through WeChat, face-to-face meetings, and email. The item screening and expert opinion adoption criteria were as follows: items were retained only if they simultaneously met all three conditions — a mean importance and relevance score >3.5, a coefficient of variation (CV, Content Validity) <0.25, and a full-score rate (K) ≥0.2 [11]. After collecting the first-round questionnaires, key metrics, including expert response rate (positive coefficient), authority coefficient, importance and relevance scores for each risk factor, CV values, and K values, were calculated. Based on the consolidated expert feedback and statistical analysis, the assessment scale content was revised according to the established screening criteria. The research team then discussed the expert opinions to determine whether to accept proposed modifications and delete items with weak thematic relevance, resulting in the formulation of the second-round Delphi questionnaire. The second round was conducted two weeks later and included: (1) feedback on the first-round results, (2) importance and relevance ratings for risk warning factors in the second round, (3) expert demographic information, and (4) expert self-evaluation. The consultation results were systematically analyzed and, in conjunction with the screening criteria and expert recommendations, the risk warning factor assessment table was further refined to produce the final version of the evaluation scale.

2.7. Statistical indicators and scoring criteria

The statistical indicators primarily included the experts' positive coefficient, authority coefficient, and the degree of coordination among expert opinions. The positive coefficient reflected the experts' engagement with the research, as indicated by the response rate of the consultation questionnaires and the number of experts providing feedback, with a response rate exceeding 70% considered indicative of high expert enthusiasm. The authority coefficient (Cr) was determined by both the experts' judgment basis (Ca) and their familiarity level (Cs), calculated as $Cr = (Ca + Cs) / 2$; generally, a Cr value greater than 0.70 was regarded as indicating high reliability. The degree of coordination among expert opinions was expressed using Kendall's coordination coefficient (W), which ranged from 0 to 1, with values closer to 1 signifying higher consistency among expert opinions. The coefficient of variation (CV), calculated as the standard deviation divided by the mean (CV = standard deviation/mean), was used to assess the uniformity of expert opinions, where a smaller CV indicated greater consensus among experts. For the consultation questionnaire, the importance of

items was rated using a 5-point Likert scale (1–5), ranging from "Strongly disagree" (1) to "Strongly agree" (5), while relevance was assessed using a 4-point Likert scale (1–4), ranging from "Very irrelevant" (1) to "Highly relevant" (4). The familiarity level (Cs) was categorized as "Very familiar" (1.0), "Familiar" (0.8), "Moderately familiar" (0.6), "Not very familiar" (0.4), and "Not familiar at all" (0.2). The judgment basis was scored according to the degree of influence (large, medium, small), with practical experience assigned values of 0.5, 0.4, and 0.3; theoretical analysis assigned 0.3, 0.2, and 0.1; knowledge of domestic and international peers assigned 0.1, 0.1, and 0.1; and intuition also assigned 0.1, 0.1, and 0.1 for large, medium, and small influences, respectively.

2.8. Quality control

Data management was conducted using Excel 2013 to record experts' ratings and modification suggestions for each scale item, with all entries double-checked, numbered, and entered by two independent researchers. To ensure the quality of the study: (1) All consulted experts were senior professionals with a strong interest in the research topic and capable of providing comprehensive perspectives; (2) The first-round questionnaire was developed based on literature review and preliminary clinical surveys, and offered in three formats (Word document, Wenjuanxing QR code, and paper version) for expert convenience; (3) Questionnaires were distributed via private WeChat messages using personalized and cordial language, with regular follow-ups to enhance response quality; (4) After collection, Wenjuanxing responses were directly exported to Excel, while Word-format questionnaires were independently entered by two researchers and cross-verified; (5) Any disputed indicators were discussed by the research team, with additional explanations sought from relevant experts when necessary.

2.9. Statistical methods

Statistical analyses were performed using Excel 2013 and SPSS 26.0 software. For quantitative data, normally distributed variables were expressed as mean ± standard deviation (SD) ($\overline{x} \pm s$), and intergroup comparisons were conducted using *t*-tests. Categorical data were presented as frequency and percentage (%), with intergroup comparisons performed using chi-square tests. The positive coefficient of experts was indicated by the effective questionnaire recovery rate, calculated as (number of valid returned questionnaires/ number of consulted experts) × 100%. The authority coefficient (Cr) of experts was derived from the judgment basis coefficient (Ca) and the familiarity coefficient (Cs) regarding the survey content, where a higher Cr value indicated greater expert authority[12]. The degree of consensus among expert opinions was evaluated using the coefficient of variation (CV) and Kendall's W coefficient, where a smaller CV and a larger Kendall's W value indicated better consistency among experts[13]. Statistical significance was set at $P < 0.05$.

3. Results

3.1. General information on the experts

A total of 24 experts were ultimately included, comprising 6 males and 18 females, with ages ranging from 36 to 55 years (mean ± SD: 44.83 ± 5.61 years) and professional experience in their respective fields spanning 11 to 31 years (mean ± SD: 20.33 ± 6.74 years). The detailed demographic characteristics are presented in **Table 1**.

Table 1. Basic Information of the Consulted Experts (*n*=24)

Item		No.	Percentage (%)
Gender			
	male	6	25.00
	female	18	75.00
Age (years)			
	31~40	8	33.33
	41~50	12	50.00
	≥51	4	16.67
Education level			
	Bachelor's degree	14	58.33
	Master's degree	10	41.67
Professional title			
	Intermediate title	8	33.33
	Associate senior title	12	50.00
	Senior title	4	16.67
Work experience (years)			
	11~20	9	37.50
	21~30	14	58.33
	≥31	1	4.17
Field of expertise			
	Clinical rehabilitation nursing	10	41.67
	Nursing teaching and research	1	4.17
	Nursing management	4	16.67
	Clinical medicine	5	20.83
	Clinical nutrition	5	20.83

3.2. Expert responsiveness

In the first round of Delphi consultation, 25 questionnaires were distributed with 24 returned, yielding a recovery rate of 96%. The second round distributed 24 questionnaires, with all 24 returned, achieving a 100% recovery rate. Across both rounds, experts provided importance and relevance evaluations for all items, demonstrating a 100% response rate. The modification rates of expert feedback were 62.50% in the first round and 16.67% in the second round, indicating high levels of expert engagement.

3.3. Expert authority

For the two Delphi rounds, the judgment basis coefficients (Ca) were 0.926 and 0.933, familiarity coefficients (Cs) were 0.800 and 0.808, and authority coefficients (Cr) were 0.863 and 0.871, respectively. These values confirm high expert authority, ensuring reliable consultation outcomes.

3.4. Degree of expert consensus and coordination

The content validity of the assessment scale demonstrated strong reliability, with item-level content validity indices (I-CVIs) ranging from 0.875 to 1.000 and a scale-level content validity index (S-CVI) of 0.977. In the first round of expert consultation, dimension importance scores averaged between 4.000 and 4.250 (CV =

0.191–0.211), while item importance scores ranged from 3.667 to 4.917 (CV = 0.056–0.399), yielding a final importance score of 4.322 (CV = 0.182) with full-score rates of 0.21–0.92. For relevance, dimension scores averaged 3.542–3.625 (CV = 0.134–0.163) and item scores ranged from 3.375 to 3.398 (CV = 0.050–0.279), resulting in a final relevance score of 3.650 (CV = 0.148) with full-score rates of 0.50–0.96.

The second round showed improved consistency, with dimension importance scores of 4.125–4.458 (CV = 0.171–0.202), item importance scores of 3.833–4.875 (CV = 0.068–0.246), and a final importance score of 4.379 (CV = 0.174) with full-score rates of 0.29–0.92. Relevance scores were similarly refined, with dimension averages of 3.583–3.708 (CV = 0.123–0.137), item averages of 3.542–3.958 (CV = 0.050–0.199), and a final relevance score of 3.717 (CV = 0.126) with full-score rates of 0.54–0.96.

Statistical analysis revealed significant expert agreement, with Kendall's W coefficients for importance at 0.192 ($P < 0.001$) in the first round and 0.154 ($P < 0.001$) in the second round, while relevance scores showed Kendall's W values of 0.071 ($P < 0.05$) and 0.061 ($P < 0.05$), respectively. These findings confirm a high degree of consensus among expert evaluations.

3.5. Item modification results

Following discussions among the research team, additional items were incorporated into the assessment scale, including "number of children" in the basic information section, "NIHSS score", "primary disease diagnosis", "feeding method", "types of medications taken", "types of medications for digestive symptoms", "dietary structure and preferences", "ICF function", and "standing/sitting balance" in the disease-related information section, as well as "liver and kidney function", "prealbumin level", and "hemoglobin level" in the laboratory indicators section. The final draft consisted of 3 dimensions and 36 items, comprising 10 items in Dimension 1, 21 in Dimension 2, and 5 in Dimension 3.

After the first round of expert consultation, the responses were analyzed, and modifications were made based on predefined item selection criteria through group discussions. Specifically, 3 items were revised, and 5 were added:

Newly Added Items: "degree of weight loss", "mRS score", "gastrointestinal function status", and "dietary survey."

Deleted Items: "estimated height and weight", "disease stage", and "APACHE II score."

Modified Items: The item "height and weight" was changed to "BMI", and "primary disease diagnosis" was revised to "number of disease diagnoses and their respective primary diagnoses."

The updated draft then included 3 dimensions and 37 items, with 10 items in Dimension 1, 22 in Dimension 2, and 5 in Dimension 3.

Subsequent to the second round of expert consultation, further refinements were made based on the responses and item selection criteria. Specifically, 2 items were modified ("health insurance payment type" was expanded to include "commercial insurance", and "history of previous surgeries" was revised to "history of previous gastrointestinal surgeries"), and 1 new item ("residence type") was added.

The final version of the assessment scale comprised 3 dimensions and 38 items, structured as 11 items in Dimension 1, 22 in Dimension 2, and 5 in Dimension 3 (**Table 2**).

Table 2. Results of the second-round expert Delphi consultation

	Importance				Relevance				
Serial number	**Mean**	**Standard deviation**	**CV**	**full-score rate**	**Mean**	**Standard deviation**	**CV**	**full-score rate**	
A Basic Information	4.13	0.83	0.20	0.42	3.63	0.48	0.13	0.63	reserve
B Disease-Related Information	4.25	0.83	0.20	0.50	3.75	0.43	0.12	0.75	reserve
C Laboratory indicators	4.46	0.76	0.17	0.63	3.75	0.43	0.12	0.75	reserve
A1 Gender	4.04	0.89	0.22	0.38	3.63	0.48	0.13	0.63	reserve
A2 Age	4.04	0.89	0.22	0.38	3.63	0.48	0.13	0.63	reserve
A3 Education Level	3.88	0.83	0.21	0.29	3.58	0.57	0.16	0.63	reserve
A4Employment Status	3.92	0.95	0.24	0.38	3.71	0.54	0.15	0.75	reserve
A5 Caregiving Type	4.17	0.99	0.24	0.46	3.75	0.43	0.12	0.75	reserve
A6 Monthly Family Income	3.83	0.94	0.25	0.29	3.54	0.64	0.18	0.63	reserve
A7 Type of Medical Insurance	4.13	0.88	0.21	0.42	3.58	0.64	0.18	0.67	reserve
A8 Marital Status	4.33	0.75	0.17	0.50	3.75	0.52	0.14	0.79	reserve
A9 Number of Children	4.17	0.80	0.19	0.42	3.54	0.71	0.20	0.67	reserve
A10 Smoking History	4.13	0.97	0.24	0.46	3.58	0.64	0.18	0.67	reserve
A11 Alcohol Consumption History	3.92	0.91	0.23	0.33	3.96	0.20	0.05	0.96	reserve
B1 Admission Method	4.25	0.78	0.18	0.46	3.54	0.50	0.14	0.54	reserve
B2BMI	4.71	0.54	0.11	0.75	3.83	0.37	0.10	0.83	reserve
B3 Weight Loss	4.54	0.71	0.16	0.67	3.79	0.41	0.11	0.79	reserve
B4 Number of Diagnosed Diseases	4.54	0.71	0.16	0.67	3.75	0.43	0.12	0.75	reserve
B5 Onset Time	4.46	0.71	0.16	0.58	3.71	0.45	0.12	0.71	reserve
B6 First-Ever Stroke (Yes/No)	4.08	1.00	0.24	0.46	3.92	0.28	0.07	0.92	reserve
B7 Comorbidities	4.88	0.33	0.07	0.88	3.96	0.20	0.05	0.96	reserve
B8 Gastrointestinal Medications	4.63	0.63	0.14	0.71	3.71	0.45	0.12	0.71	reserve
B9 Number of Medication Types	4.17	0.75	0.18	0.38	3.71	0.45	0.12	0.71	reserve
B10 Activities of Daily Living (ADL) Score	4.50	0.76	0.17	0.67	3.63	0.63	0.17	0.71	reserve
B11 mRS score (Modified Rankin Scale score)	4.54	0.64	0.14	0.63	3.58	0.57	0.16	0.63	reserve
B12 Dysphagia (Swallowing disorder)	4.83	0.37	0.08	0.83	3.58	0.49	0.14	0.58	reserve
B13 Gastrointestinal function assessment	4.58	0.64	0.14	0.67	3.79	0.41	0.11	0.79	reserve
B14 Psychological depression status	4.38	0.63	0.14	0.46	3.58	0.70	0.20	0.71	reserve
B15 NIHSS score (National Institutes of Health Stroke Scale score)	4.46	0.91	0.20	0.67	3.79	0.50	0.13	0.83	reserve
B16 ICF function (International Classification of Functioning, Disability and Health function)	4.33	0.90	0.21	0.58	3.58	0.49	0.14	0.58	reserve
B17 Feeding method	4.79	0.50	0.10	0.83	3.83	0.37	0.10	0.83	reserve
B18 Dietary structure and preferences	4.21	0.87	0.21	0.46	3.83	0.37	0.10	0.83	reserve
B19 Past medical history	4.42	0.81	0.18	0.58	3.83	0.37	0.10	0.83	reserve

	Importance				Relevance				
Serial number	Mean	Standard deviation	CV	full-score rate	Mean	Standard deviation	CV	full-score rate	
B20 History of previous gastrointestinal surgery	4.21	0.96	0.23	0.46	3.67	0.47	0.13	0.67	reserve
B21 Timely treatment during the acute phase	4.38	0.75	0.17	0.54	3.67	0.47	0.13	0.67	reserve
B22 Dietary survey	4.54	0.64	0.14	0.63	3.75	0.43	0.12	0.75	reserve
C1 Hemoglobin level	4.88	0.44	0.09	0.92	3.83	0.37	0.10	0.83	reserve
C2 Electrolyte level	4.54	0.64	0.14	0.63	3.79	0.41	0.11	0.79	reserve
C3 Albumin level	4.75	0.60	0.13	0.83	3.88	0.33	0.09	0.88	reserve
C3 Prealbumin level	4.79	0.58	0.12	0.88	3.83	0.37	0.10	0.83	reserve
C4 Liver function	4.29	0.89	0.21	0.58	3.58	0.49	0.14	0.58	reserve
C5 Renal function	4.58	0.70	0.15	0.71	3.75	0.43	0.12	0.75	reserve

4. Discussion

4.1. The nutritional risk assessment scale for stroke patients in the recovery phase demonstrates good scientific validity and reliability

Currently, the assessment of nutritional risk in stroke patients during the recovery phase primarily relies on generalized (non-specific) scales, while specialized scales are still lacking [14]. In this study, based on the modified Delphi method, the authors provided structured questionnaires—developed through literature review and expert group discussions—to the consulting experts during the first round of consultation. Compared with the traditional Delphi method, the modified Delphi method concludes when consensus on the discussed topic is reached, making it more convenient for experts to make inferences and judgments within a short time [15]. Additionally, feedback on expert opinions was provided after the first round of consultation, which helped improve the accuracy and efficiency of the research.

In the selection of experts, all consulting experts had over 10 years of experience in relevant fields, with extensive clinical, nursing, and management expertise. Among them, 16 experts held associate senior or higher professional titles, and 10 experts had master's degrees.

The response rates for the two rounds of expert consultation questionnaires were 96% and 100%, respectively, and all experts evaluated the importance and relevance of the items, with a response rate >70%, indicating high enthusiasm among the experts [16]. The modification rates of expert opinions in the two rounds were 62.50% and 16.67%, respectively, demonstrating high engagement among the experts. The Cronbach's alpha (Cr) values for the two rounds of expert consultation were 0.863 and 0.871, both greater than 0.7, indicating high expert authority and reliable consultation results [17].

The Kendall's W coefficients for importance in the two rounds were 0.192 and 0.154 (both $P < 0.001$), while those for relevance were 0.063 and 0.067 (both $P < 0.05$), suggesting a high degree of consistency in expert evaluations of the indicators [18].

4.2. The nutritional risk assessment scale for stroke patients in the recovery phase demonstrates strong targeted applicability

Stroke patients in the recovery phase often experience dysphagia, cognitive impairment, and depression,

all of which contribute to an increased risk of malnutrition [6, 19–21]. Additionally, certain medications may exacerbate gastrointestinal burden, leading to impaired nutrient absorption [22]. Moreover, laboratory indicators such as albumin and prealbumin reflect the patient's nutritional risk to some extent [23–24]. In this study, through a literature review, the authors analyzed and summarized the key risk factors for malnutrition in stroke patients during the recovery phase [11, 25]. By employing the Modified Delphi Method for expert consultation, the authors developed a targeted nutritional risk assessment scale specifically for stroke patients in the recovery phase, enhancing its applicability and relevance to this patient population.

4.3. The nutritional risk assessment scale for stroke patients in the recovery phase demonstrates good practicality

Currently, for stroke patients in the recovery phase, clinically available tools for assessing malnutrition risk include the Nutritional Risk Screening 2002 (NRS2002) and the Malnutrition Universal Screening Tool (MUST) [25–26]. However, these tools have limited efficacy in identifying high-risk populations with malnutrition risk among stroke patients in the recovery phase. The nutritional risk assessment scale for stroke patients in the recovery phase developed in this study integrates demographic data, disease-related information, and laboratory indicators of patients, providing a reference for screening high-risk stroke patients with malnutrition.

5. Summary

This study developed a nutritional risk assessment scale for stroke patients in the recovery phase through a modified Delphi approach, integrating literature review and two rounds of expert consultation. And the final scale comprises 3 dimensions and 38 items. The development methodology demonstrated strong scientific validity and reliability, while the derived items exhibited notable targeting and practicality. This scale provides practical guidance for clinical practice and serves as a reference for accurately and efficiently identifying high-risk stroke patients with malnutrition during the recovery phase.

6. Limitations and future directions

The limitation is that all participating experts were from a single hospital, which may introduce potential biases in the findings. Future work will focus on applying the developed scale, including integrating it into software systems to enable automated calculation of patients' malnutrition risk scores, in order to validate its feasibility and practical effectiveness. Efforts will also be made to develop a risk prediction model.

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Disclosure statement

The authors declare no conflict of interest.

Reference

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